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Application No.: 81 105 516.9

Publication No.: 0 045 408

Title of invention: Flexible coated abrasive sheet material

Classification: B24D 11/02

D E C I S I O N
of 20 February 1991

Proprietor of the patent: Norton Company

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03 Feldmühle Aktiengesellschaft
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09 Gustav Ernstmeier GmbH & Co. KG

Headword:

EPC Articles 56, 123

Keyword: "inventive step - yes"

Headnote

Europäisches Patentamt | European Patent Office | Office européen des brevets

Beschwerdekammern | Boards of Appeal | Chambres de recours

Case Number : T 131/89 - 3.2.4

D E C I S I O N
of the Technical Board of Appeal 3.2.4
of 20 February 1991

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Decision under appeal :	**Decision of Opposition Division of the European Patent Office dispatched on 2 December 1988 revoking European patent No. 45408 pursuant to Article 102(1) EPC.**

Composition of the Board :

Chairman : C. Andries
Members : H. Seidenschwarz
O. Bossung
H. Ostertag
J. De Preter

Summary of Facts and Submissions

I. European patent No. 45 408 comprising eight claims was granted on 15 May 1985 in response to European patent application No. 81 105 516.9 filed on 14 July 1981.

II. Nine oppositions were filed against the European patent requesting that it be revoked.

III. The Opposition Division revoked the European patent by its decision dispatched on 2 December 1988 on the ground that the subject-matter of the Claims 1 according to the main, first auxiliary and second auxiliary requests, among other things, did not involve an inventive step in view of the teachings disclosed in the following documents (the numbering used corresponds to that set out in the Opposition Division's decision):

D3: DE-A-2 333 980;
D11: US-A-3 169 899;
D12: Interkolor 77, Budapest, September 13-16, 1977
"Zeitgemässe Wirtschaftliche und Ästhetische Textilausrüstung". No. 32;
J. Krystufek: Thermofixierung und Kondensation als Einstufenprozess bei der Ausrüstung der neuentwickelten generation von Arachne-Nähwirkstoffen für Bekleidungsqualitäten.

IV. The Appellant (Proprietor) lodged an appeal against the decision on 30 January 1989, paying the appeal fee simultaneously. The Statement of Grounds was received on 12 April 1989.

V. In the communication pursuant to Article 11(2) of the Rules of Procedure of the Boards of Appeals dated 4 September 1990 the Board referred additionally to the following documents (the numbering used corresponds also to that set out in the Opposition Division's decision):

D1: DE-C-1 427 569.

D15: Deutsche Textiltechnik 15 (1965), Heft 9, page 484; W. Scholtis, R. Pfeffer: Vorteile des Einsatzes von Nähgewirken für technische Verwendungszwecke.

D17: Deutsche Textiltechnik 21 (1971), Heft 6, page 365; Günther Fritsche: Die Vorteile der Nähwirktechnik Malimo bei der Herstellung technischer Textilien.

D18: Malimo 77, Internationales Symposium Nähwirktechnik, Karl-Marx-Stadt, DDR; No. 13, page 1; H. Westphal: Der Einsatz von Malimo-Nähgewirken als zugkraftübertragende Einlage und Schutzeinlage in Gummifördergurten.

VI. Oral proceedings took place on 20 February 1991. Nobody was present on behalf of the Opponents 03 and 08, who had been duly summoned pursuant to Rule 71(1) EPC and had written to say they would not be attending. The proceedings, therefore, were continued without them (Rule 71(2) EPC).

During the oral proceedings the Appellant filed a new set of Claims 1 to 3 and a revised description of the patent (containing only pages 2, 2a, 3 to 5 and 7, there being no pages 1 and 6).

Claim 1 reads as follows:

"A flexible coated abrasive endless belt having abrasive grains adhesively bonded to at least one side of a backing

consisting of a structure of at least two arrays bound to each other by a stitching yarn, each of said arrays being of non-interlaced substantially coplanar and coparallel reinforcing textile yarns, said arrays being oriented in at least two respective distinct directions in the plane of the backing, most of the tensile strength of the coated abrasive sheet material along each of said at least two directions being furnished by the yarns of all the arrays of non-interlaced substantially coplanar and coparallel yarns oriented in said directions, one of said arrays forming the warp yarns and another of said arrays running in the fill direction, and optionally a thin tissue sheeting between the warp and fill yarns, said structure being front, respectively back, filled to fill spaces between the yarns and the grains being attached on the such treated backing via a maker coat."

1. The Appellant argued as follows:

(i) Having regard to the wording of Claim 1:

The replacement of the word "comprising" by the expression "consisting of" limits the subject-matter of Claim 1 to a structure of at least two arrays bound to each other by a stitching yarn. This excludes any further type of layer.

The strength of the endless belt is mainly provided by the reinforcing textile yarns. These yarns must take up most of the tensile force in the belt and, therefore, one of the arrays, i.e. the array forming the warp yarns, is oriented in the longitudinal direction of this belt. This is common use in the techniques of continuous belts.

The front, respectively back, filling of the spaces between the yarns of the above-mentioned structure is one of the various features mentioned in the description of the patent as granted, which features can be applied for finishing stitch bonded fabrics as backings for abrasive endless belts. The purpose of the maker coat is to fix rigidly the abrasive grains to the surface of a backing and does not replace the backing itself.

(ii) Having regard to the inventive step of the subject-matter of amended Claim 1:

Coated abrasive endless belts having a backing in the form of a sateen woven cloth are commonly known. An example of such a backing is disclosed in document D1. This document, however, discloses only a first approach towards avoiding the disadvantages of types of other woven cloths used as backings.

Document D12 deals with the improvement of a special type of stitch-bonded fabrics (Arachne) and the different applications of said fabrics, e.g. to an emery cloth, which are, however, unsuitable to be used as an endless abrasive belt.

From the documents D15, D17 and D18 it is known to employ stitch-bonded, Malimo type fabrics as inserts in conveyor belts which, however, cannot be regarded as being subject-matter neighbouring coated abrasive endless belts.

None of the other documents cited by the Respondents gives any suggestion to improve a flexible coated abrasive endless belt within the meaning of the subject-matter as specified in Claim 1, so that it can be used even for heavy grinding operations.

2. The objections of most of the Respondents (Opponents 01, 02, 04, 06, 07 and 9) can be summarised as follows:

(i) Having regard to the amendments to Claim 1:

An optional feature is not admissible in an independent claim.

It is not disclosed in the application as filed and in the patent as granted that layers having structures which are different from the at least two arrays of yarns bound to each other by a stitching yarn are excluded from being used in the backing as specified in Claim 1. The replacement of the word "comprising" by "consisting of" is, therefore, not justified.

The feature which concerns the front or back filling of the structure of said arrays is not disclosed in the description as an essential feature of the invention, since the finishing step of said structure includes many different features according to the description of the patent in suit (cf. page 2, lines 60 to 62).

(ii) Having regard to the inventive step of the subject-matter of the amended Claim 1:

In document D1 the problems connected with the use of woven cloths as backings for coated abrasive endless belts are mentioned. This document leads the person skilled in the art already in the direction he has to go for solving said problems.

From document D3, which refers to document D1, the person skilled in the art learns to replace woven cloths by arrays of yarns (layer (a)) which have no cross-over points, and, therefore, no structural elongation and knuckles. According to the embodiment as shown in Figure 3, three arrays of yarns are adhesively bonded to a support (layer (b)) and the yarns of one of said arrays are oriented in the warp direction. However, the only and simpler alternative to adhesively bounded arrays is arrays bound to each other by stitching yarns. Furthermore, it is obvious to replace the support (layer (b) in the form of oriented fleece fibres) by an array of yarns and to bind it to the upper arrays by stitching yarns if a stronger structure of the backing is wanted.

Such an alternative and replacement is also obvious in the light of the teaching of document D12, according to which a longitudinal yarn system laid on a fleece and stitch bound to the fleece for providing a fabric which is used for the production of emery cloth (Schmirgelleinen) with reduced elongation. The reference to the reduced elongation of said emery cloth means clearly that it has warp yarns oriented in its longitudinal direction. Such an emery cloth belongs to the same technical field as coated

abrasive endless belts and the expression "Schmirgelleinen" is also a generic term for "Schleifmittel". Therefore, an emery cloth is mostly used as an endless belt. Furthermore, it is also obvious to the person skilled in the art to replace the fleece in the fabric known from Document D12 by an array of yarns, since a fleece is equivalent to such an array.

Finally, it is known to use Malimo type fabrics as backings for abrasives according to a letter from Enka Glanzstoff AG dated 11 August 1975 (filed by the Respondent 07 with his letter of 7 September 1989).

Consequently, the subject-matter of the amended Claim 1 does not involve an inventive step vis-à-vis the teaching of the prior art.

3. The arguments of the Respondent 05 (Opponent 05), supporting the Appellant's opinion, are that

- document D1 teaches to reduce the elongation of woven cloths by reducing the number of knuckles which are responsible for the wear of abrasive endless belts;

- according to document D3 these knuckles could be avoided by yarn layers which are adhesively bonded to a fleece as a support and,

- since stitch-bonded fabrics present knuckles which are even more pronounced than those of a sateen weave fabric, the person skilled in the art would

not consider the fabric as disclosed in document D12 to be suitable for a backing of an abrasive endless belt.

4. The Board of Appeal referred to the document

D28: Brockhaus Enzyklopädie; Band 16; F.A. Brockhaus Wiesbaden; 1973; page 705, catchword "schleifen".

VII. The Appellant requests that

1. the decision under appeal be set aside, and
2. the patent be maintained on the basis of the documents filed during the oral proceedings, Claims 1 to 3 and description as amended (cf. above point VI).

VIII. The Respondents 01, 02, 04, 06, 07, 08 and 09 request that the appeal be dismissed.

Respondent 05 requests that the patent be maintained as requested by the patentee.

Respondent 03 (not present) requests that the case be decided on the file as it stands.

Reasons for the Decision

1. The appeal is admissible.

2. Amendments

2.1 Claim 1 comprises a combination of the features of the Claims 1, 4, 6 and 7 as filed and granted and in the description as filed and granted (cf. EP-A-0 045 408:

page 3, lines 4 to 7, 16 to 25; page 3, line 35 to page 4, lines 22; page 5, lines 7 to 12; Example 1; EP-B-0 045 408: page 2, lines 50, 51, 57 to 62; page 3, lines 3 to 11, 24 to 26; Example 1).

2.2 The expression "consisting of" restricts the subject-matter of Claim 1 to

- a structure of at least two specifically defined arrays bound to each other by stitching yarns,

or, according to the further variant of the subject-matter of Claim 1 defined following the word "optionally" in Claim 1 to

- a structure of at least two said specifically defined arrays bound to each other by stitching yarns as specified above and a thin tissue sheeting between the warp and fill yarns forming said two arrays.

Due to the expression "consisting of", which is of a limitative nature, there is no possibility of further unspecified additional structural features.

Claim 1, therefore, clearly excludes any structure which does not have the same design and properties of the structure as defined above.

Both above defined structures are unequivocally disclosed in the application as filed (page 3, lines 4 to 7 and 35, 36) as well as in the granted patent (page 2, lines 50 and 51; and page 3, lines 3 and 4).

2.3 From the above it is also clear that the expression "optionally" does not introduce any ambiguity in Claim 1. In the present case, it only defines two alternative solutions, so that Claim 1 has to be considered as a combination of two independent claims.

Hence, this expression can be allowed in Claim 1.

2.4 In response to the objection that the description of the patent in suit does not support the feature of front, respectively back, filling the structure as specified in Claim 1, being essential to the invention, reference is made to the description as originally filed (cf. page 3, lines 18 to 25) and granted (cf. page 2, lines 58 to 62). According to said description the overall production of coated abrasive from stitch-bonded fabrics is closely analogous to production from conventional woven cloth and in this production the different steps as specified may all be used, which implies that each of the steps can be used alone or in combination with any other of these steps. Two examples are given in the original description of coated abrasive sheets, one of which (Example 1) applies the steps of front and back filling a stitch-bonded fabric and applying a maker coat and abrasive grains to the coated fabric, whereas the other (Example 2) applies the step of front sizing a fabric in combination of applying also a maker coat and abrasive grains to the final backing.

Consequently, adequate support is given for the contested feature in the description as originally filed and granted. The EPC requires that a feature added to a claim has, in order to be allowable, to be disclosed in the application as filed, but does not require that such a feature has to be defined as essential in the application as filed. Furthermore, the introduction of said feature

results in a restriction of the scope of Claim 1. Therefore, there is no formal objection to the current version of Claim 1.

2.5 The current Claims 2 and 3 are disclosed in the application as filed (cf. Claim 4 and page 11, lines 36 and 37) and correspond to Claims 3 and 8 as granted.

2.6 The amendments in the description result from the amendments in Claim 1 and the correction of an obvious error (page 2a, second last remaining line).

2.7 The patent, therefore, complies with Article 123(2) and the claims with Article 123(3) EPC.

3. Interpretation

To assess the subject-matter of Claim 1 properly, the expressions "substantially coplanar", "substantially coparallel", and "one of said arrays forming the warp yarns and another of said arrays running in the fill direction" are interpreted on the basis of the definitions given in the description (granted patent: page 2, lines 37 to 41) and on the basis of the Appellant's submissions during the oral proceedings that the warp yarns are oriented in the running direction of the endless belt, which is common knowledge in the technical field of flexible coated abrasive endless belts.

Furthermore, it is clear from the wording of Claim 1 as well as from the description that the front, respectively back, fill coating for filling the spaces between the yarns can neither be considered as elements of the structures as defined in above point 2.2, nor as elements furnishing most of the tensile strength of the coated abrasive sheet material along each of said at least two

directions. Said structures and said fill coating, however, form together the final backing.

4. Novelty

None of the documents cited in the proceedings before the European Patent Office discloses a flexible coated abrasive endless belt according to Claim 1. To give reasons is unnecessary since during the oral proceedings the Respondents did not dispute any more the novelty with respect to the state of the art known from the available documents.

Hence, the subject-matter of Claim 1 is novel within the meaning of Article 54 EPC.

5. Inventive step

The invention concerns an abrasive endless belt formed from a coated abrasive product which comprises a flexible backing to at least one side of which are adhesively bonded abrasive grits.

5.1 Reading the statements in the introductory part of the description of the patent in suit (cf. page 2, lines 6 to 11), the person skilled in the art learns that the state of the art available to the public before the claimed priority date includes various types of backings for making coated abrasives.

One of them is made for strength and flexibility from woven cloth backings. Problems connected with the use of woven cloth as a backing for coated abrasive endless belts are the elongation characteristic inherent in woven cloth due to the interlaced nature of the material, and weakening of the material in certain circumstances due to

the inherent presence of "knuckles" at the cross-over points in the yarn. The presence of these knuckles is believed to be responsible for the failure of flexible coated abrasive endless belts in certain severe grinding operations.

5.2 It follows from the discussions of the prior art by the parties during the oral proceedings that the technical problem to be solved by the invention was to improve the overall performance of said existing flexible coated abrasive endless belts.

5.3 According to the teaching of Claim 1 this problem is essentially solved by using for the backing a non-interlaced fabric such as a stitch-bonded fabric. This fabric has warp yarns laid almost parallel in a single plane and fill yarns laid almost parallel in a single plane below or above the plane of the warp yarns and bonded thereto by stitching yarns.

Such a structure has reduced stretchability and a rather uneven surface resulting from a plurality of knuckles where the stitching yarns cross over the warp and fill yarns to anchor them in position and from the open spaces inherent in the open structure of stitch-bonded fabrics. This open construction on the other hand has a greater capacity to receive fill material for filling the spaces between the yarns than the very dense and tightly packed structure of a woven cloth presenting a smooth surface to the fill material.

5.4 As regards a relevant source in the art for the above modifications of woven cloth backings, it is important to consider the flexible coated abrasive endless belt according to document D1, and the laminated web material according to document D3 designed for making said belt.

5.4.1 Document D1 concerns a wide coated abrasive endless belt ("Breitschleifband"), which consists of individual sections of a backing. These sections have the shape of a parallelogram and are connected with each other to form the endless belt in such a manner that the warp yarns run at an angle to the moving direction of the belt. The backing consists of a sateen weave structure which has equal breaking load and equal elongation in the warp direction and in the fill direction (cf. Claim 1).

The purpose of this embodiment of backing is the provision of such a belt which does not distort or give undesirable elongation (cf. column 1, lines 46 to 50).

The advantage of using this sateen weave structure is to be seen in the fact that it has a smoother surface than other woven cloths, like linen weave fabrics or twill weave fabrics, since the number of cross-over points and, therefore, that of the knuckles on its surface, are smaller than on the surfaces of the other woven cloths (cf. also document D3, page 2, paragraph 3). This results in a higher resistance to wear and in a smaller elongation of the sateen weave structure than is achieved by all the other types of woven cloths (cf. column 1, lines 38 to 45; column 2, lines 19 to 30).

5.4.2 From document D3 it is known to replace the backing of the belt according to document D1 by a backing made of a laminated web material. This backing consists of a structure of a textile layer-element (a) and a conventional layer-element (b) made from paper, fleece, fibres, fabrics or combinations of paper and fabrics, which structure is coated with abrasive grits.

The textile layer-element is manufactured so as to comprise yarns running at an angle to the longitudinal direction and to the cross-direction of the laminated web material, so that the final endless abrasive belt, being made of a plurality of parallelogram-shaped sections, contains yarns extending in the moving direction thereof. This feature reduces further the elongation and increases the resistance to breaking as well as the dimensional stability of the final belt with respect to avoiding any formation of creases (cf. page 1, paragraphs 1 and 3; page 2, paragraph 3 to page 3, paragraph 1; Claim 1) and is obtained either by cutting a tubular woven fabric along a helix, by using a triaxial woven fabric or by using an array of yarns (Fadengelege).

According to the particular manufacturing method of using an array of yarns, the structure is produced by laying superimposed arrays of yarns oriented in appropriate directions onto the layer-element (b) and by bonding the yarns to said layer-element in a known manner (cf. page 3, last paragraph; Claims 4 and 7). However, according to the further disclosure of said document, adhesives and heat are applied for bonding the textile element to the layer-element (cf. page 4, lines 10 to 29; page 5, lines 3 to 8; Claims 8, 9 and 11). No other means of joining both elements together and no reference relating to the advantages which result from the absence of any knuckles is disclosed in document D3.

5.4.3 From the combined teaching of the two documents D1 and D3 the person skilled in the art learns that a possibility to avoid the problems connected with the use of a woven cloth as a backing (cf. above paragraphs 5.1 and 5.2.1) is the replacement of the woven cloth by either a sateen weave fabric (D1) or a combination of a textile layer-element and a conventional layer-element (D3). Document D3

suggests, without indicating a preference, three possibilities for that textile layer-element (tubular woven fabric, triaxial woven fabric, array of yarns), so that the person skilled in the art is not even directly led or forced to use an array of yarns. Furthermore, if such an array of yarns were to be chosen, it has to be adhesively bonded to the further conventional layer-element made of paper, fleece, fibres, fabrics and paper-fabric combinations. Consequently, no hint can be derived from document D3 either to replace the layer-element (b) by a further array of yarns, or to drop said layer-element completely, or to replace the adhesive bonding by stitch-bonding.

5.4.4 Since document D3 discloses a further development of an endless belt according to document D1, it cannot be accepted by the Board that it is obvious for a person skilled in the art to take only a part of the teaching of document D3, namely the use of an array of yarns (Claim 4), and to use only that part as a backing in a belt according to document D1. Without any suggestion in the available prior art, the use of only parts of a teaching is the result of an ex post facto analysis.

5.5 Document D12 refers to the production of fleece cloths by stabilising a fleece with binding threads according to a modified Arachne-technology. The principle of said technology is based on the insertion of a longitudinal thread system on the fleece prior to stitch bonding with a further thread system (Optimix fabric, page 1, top of second paragraph). From this it is clear that this type of textile consists of a structure of only one array of longitudinal yarns laid on the fleece and bound to said layer by a stitching yarn.

In its introductory part, document D12 teaches that said textile has a higher dimensional stability than classical Arachne-type fabrics. This permits a more effective use in cases where the application of the classical Arachne-technology would cause difficulties. In this manner, various types of garment liners, book cloths, emery cloths with reduced elongation and decorative fabrics can be produced very economically in comparison with woven fabrics (cf. page 1). The Board agrees with the Appellant that a person skilled in the art, wanting to improve the overall performance of existing abrasive endless belts so that they can even be used under heavy grinding conditions, would be very reluctant to use a teaching from a document mainly indicating technical fields which have nothing to do with the intended working conditions. Interpreting one of the indicated uses in such a manner that it suddenly opens a completely different range of working conditions which cannot be compared with the working conditions of the other indicated uses, is the result of a ex-post-facto analysis, which cannot be accepted by the Board. Furthermore, no indication is given as to the detailed construction of the fabric which would need to be taken into account for most of said end uses. The main topic of document D12 concerns finishing methods of an "Optimix"-type fabric suitable for sports shirts and the like, wherein the fabric comprises a fleece of transversally oriented fibres (cf. page 4, paragraph 3.1).

In document D12 there is not the slightest indication which could be interpreted as a suggestion to the person skilled in the art to replace - even for the purpose of manufacturing an emery cloth - in the structure of this known textile the fleece by an additional array of yarns oriented transversally to the array of longitudinal yarns.

This fact is also not altered by using such an "Optimix"-type fabric as a backing for a wide coated abrasive endless belt according to document D3, since the Board is convinced that a fleece cannot be compared with an array of yarns as defined in Claim 1.

With respect to the argument that emery cloths are also used for abrasive endless belts, reference is made to document D28, according to which emery cloths are only employed in hand grinding. Furthermore, the Respondents who submitted that the expression "Schmirgelleinen" is commonly regarded to be a generic term for "Schleifmittel" (abrasive), have failed to provide any evidence for their allegation.

5.6 The documents D15, D17 and D18 disclose the preferred application of stitch-bonded Malimo type fabrics to conveyor belts as inserts for taking-up the whole tensile force of said belts and for protecting said belts against continued tear-off propagation. This results from the good characteristics inherent in the structure of stitch-bonded fabrics like high resistance to tear-off propagation, reduced elongation and high bonding strength to coatings (cf. D15: page 484, right hand column, point 2; page 486, left hand column, lines 1 to 3; right hand column, lines 3 to 7, 22 to 24, 32 to 40; page 487, paragraph 3.7; Bild 5; D17: paragraph 1 and page 370, left hand column, lines 1 to 6 of the last paragraph; D18: page 1).

On the other hand, stitch-bonded Malimo type fabrics have a reduced tear strength (cf. D15: page 485, right column, last paragraph) compared to linen weave fabrics of the same mass per square unit. Therefore, the person skilled in the art would never consider these types of fabrics to be a suitable substitute for woven cloths in backings for

coated abrasive endless belts, since in these belts no tears can be accepted, as during the grinding process the tears would spoil the surfaces of the workpieces to be ground and would give rise to further deterioration of the belts whenever the tears contacted the workpiece.

Furthermore, the Board agrees with the Appellant that due to the structural differences and the completely different conditions of use between on the one hand conveyor belts and on the other hand flexible coated abrasive endless belts, the teaching of the documents D15, D17 and D18 cannot give a hint to a person skilled in the art to improve the overall performance of existing flexible coated abrasive endless belts, since the respective technical fields have to be considered as remote.

5.7 The Board of Appeal also considered the other documents cited in the proceedings before the European Patent Office and found that their teachings depart from the teaching of amended Claim 1 far more than the teachings of the documents cited above. Therefore, these other documents are also not prejudicial to the subject-matter of said Claim 1, either alone or in combination with the documents cited above.

5.8 In the letter of Enka Glanzstoff AG, the use of a Malimo type fabric as a backing for abrasives is mentioned. This letter, however, does not contain any indication that it does form part of the state of the art within the meaning of Article 54(2) EPC.

5.9 The subject-matter of Claim 1, therefore, involves an inventive step within the meaning of Article 56 EPC.

6. Hence, the patent can be maintained with Claim 1 as amended, together with the amended dependent Claims 2 and 3 and with the modified description.

Order

For these reasons, it is decided that:

1. The decision under appeal is set aside.

2. The European patent is maintained in an amended form on the basis of the documents presented in the oral proceedings (cf. above point VII).

The Registrar: The Chairman:

N. Maslin C. Andries

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